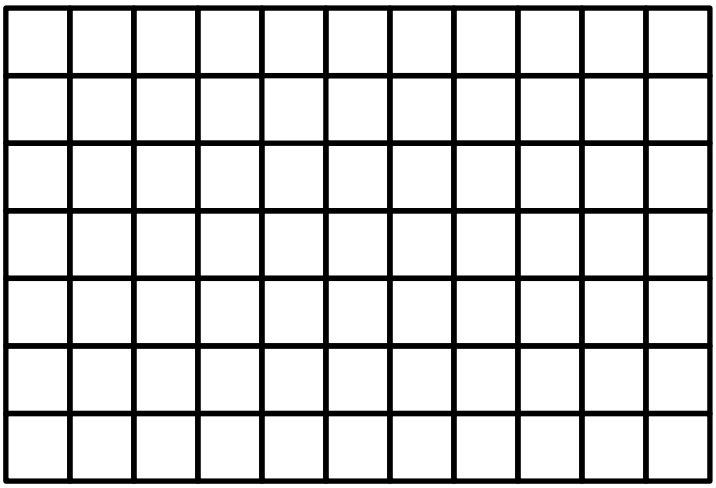
Computer Vision: Mid Exam

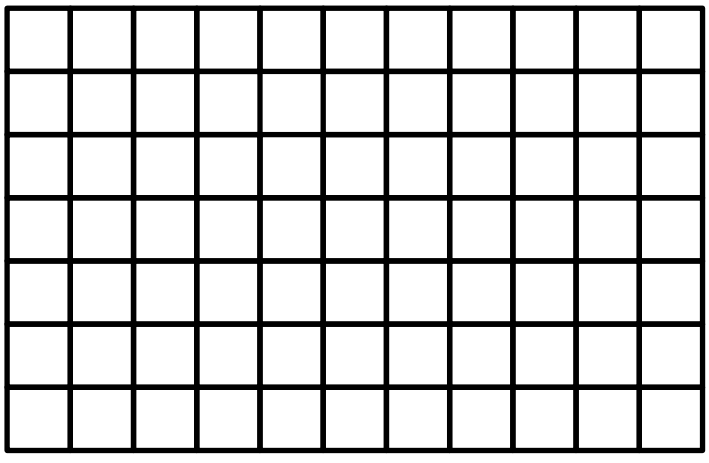
학번		이름	

3:30 – 4:45 AM, 6 May 2020

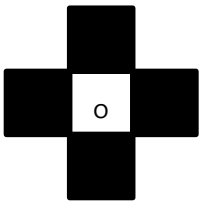
1. (15 pts) On the following pixel grid, mark some pixels in black so that there are three connected components in the context of 4-neighborhood but two connected components in the context of 8-neighborhood.



2. (15 points) On the left pixel grid, draw a binary image **B** (which is a connected component in the context of 8-neighborhood, containing at least 10 black pixels) so that its opening with the structuring element **S** is itself. In other words, $\mathbf{B} \circ \mathbf{S} = \mathbf{B}$. Note that the origin of the structuring element is labeled as 'o.'



Binary Image **B**



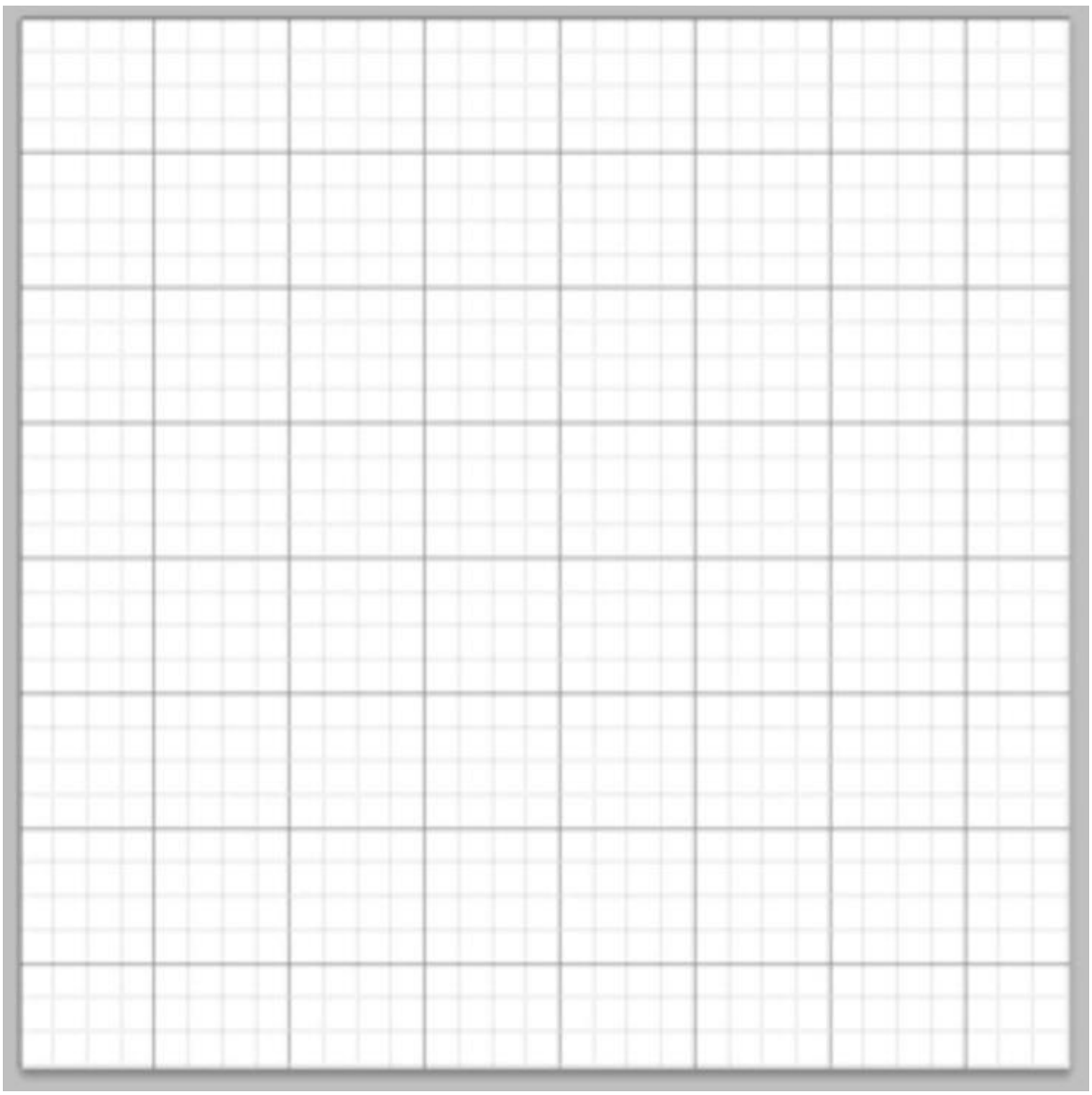
Structuring Element **S**

YOU HAVE 6 PROBLEMS IN TOTAL

3. (15 points) You are a project manager for a binary fruit classifier, which should differentiate apples from oranges. There cannot be the rejection class. Your programmer gave you an algorithm with the empirical error rate of 52%. You need to reduce the error rate in 10 minutes. What is your approach?

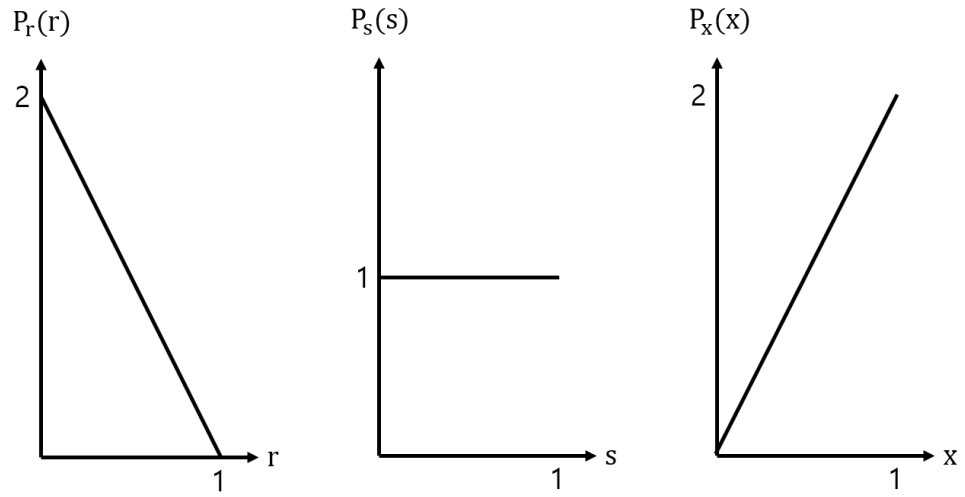
4. (15 pts) You are given the following set of four training points. What is the nearest neighbor classification rule? Give your answer by drawing the two regions neatly on the provided grid, which are classified as ω_1 and ω_2, respectively.

   Class ω_1: (1,0), (5,0)
   Class ω_2: (3,2), $(3,-4)$



YOU HAVE 6 PROBLEMS IN TOTAL

5. (20 points) An image has the gray level probability distribution function (PDF) $P_r(r)$ shown below.



(a) It is desired to transform the gray levels of this image so that they will have the uniform distribution $P_s(s)$. Assuming continuous gray levels and distributions, find the point operator $s = T_1(r)$ that will accomplish this.

(b) Similarly, find the point operator $x = T_2(r)$ so that the output gray levels have the distribution $P_x(x)$. Notice that T_2 should be monotonically increasing so that no gray level reversal occurs.

YOU HAVE 6 PROBLEMS IN TOTAL

6. (20 pts) You need to design an algorithm to count people in an image.

(c) How many people are there in the right image? What is your estimate?

(d) Describe your algorithm in any way (block diagram, pseudo-codes, etc).

YOU HAVE 6 PROBLEMS IN TOTAL